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## **EXECUTIVE SUMMARY**

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The City of Pierre, South Dakota owns and operates an electric system that provides electric service to the citizens of Pierre. DeWild Grant Reckert and Associates Company (DGR) has been commissioned to perform a system evaluation and planning study for the City.

The study performed by DGR confined itself to the "internal" City system, defined as the electrical facilities within Pierre and in the immediately adjacent areas. This report outlines an analysis of the City's system and presents recommended capital improvements to eliminate deficiencies. The Capital Improvements Plan (CIP) recommended covers a ten-year period and provides cost estimates for fiscal planning.

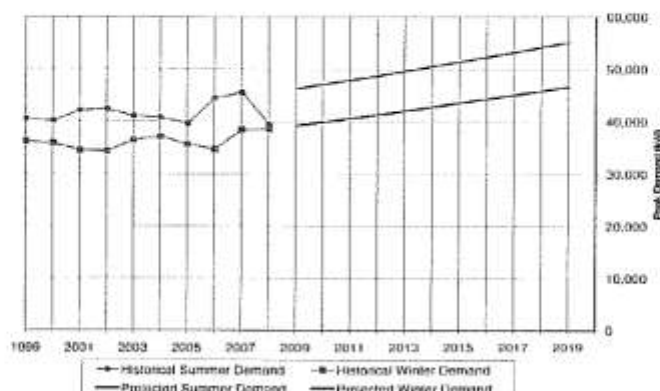
### **LOAD GROWTH AND EXISTING SYSTEM**

Over the past several years, the City's system has experienced an average growth rate of around 1.6% for the summer peak. This level of growth is average for a community the size of Pierre.

The projections for 2009 to 2019 are based on a 1.75 % annual growth rate. Based on the load growth projections, the peak system demand will increase from a level of 45,000 kW in 2007 (39,300 kW in 2008) to a level of near 55,100 kW by 2019, which can be seen in the graph on the next page. The summer projections were based off of the 2007 summer peak due to the unusually cool summer in 2008. The winter projections are based off of the 2008 winter peak.

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FIGURE 1  
SYSTEM DEMAND REQUIREMENTS  
City of Pierre, South Dakota



The City's electric system consists of a 115 kV transmission loop, three (3) load-serving substations, and thirteen (13) 12.47 kV distribution feeders. The internal transmission system is comprised of a 115 kV loop which provides looped service to all of the City's substations. The City's transmission connects to the area transmission system at two points. The first point of connection is at the WAPA Pierre Substation on the northwest side of town. The second point of connection is at the Ash Tap, which is located several miles north and west of town.

There are three (3) 115 kV to 12.47 kV substations that serve the City of Pierre. The City owns the Evans Street and Ash Street Substations, but only owns a portion of the WAPA Pierre Substation.

The existing distribution system provides electric service throughout Pierre at 12.47 kV. It consists of thirteen (13) underground circuits, three (3) fed from the WAPA Pierre Substation, four (4) from the Evans Street Substation, and six (6) from the Ash Street Substation.

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### DESIGN CRITERIA

The following is a list of criteria used in evaluation of the performance of the electric system.

- Criterion #1** Provide "N-1" (single contingency) level of reliability for all transmission, substation, and distribution facilities.
- Criterion #2** Provide ANSI "Class A" voltage service to all customers, under normal or emergency conditions.
- Criterion #3** Do not exceed thermal limitations of facilities on the electric system, under normal or emergency conditions.

### EXISTING SYSTEM DEFICIENCIES

Due to continued system growth, projected increasing loads on the system, and aging infrastructure, the following deficiencies have been identified:

- ♦ Low voltage exists on certain areas of the primary electric system, even with the distribution system intact. This situation significantly worsens during emergency conditions and becomes more widespread under anticipated future load growth.
- ♦ Inability to handle an outage of the WAPA Pierre Substation 12.47 kV bus or Feeder 1 during current peak loading periods without poor voltage conditions and overloading distribution circuits. This situation will worsen under anticipated future load growth.

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- ◆ Inability to handle an outage of the Ash Street Substation transformer, 12.47 kV bus or Feeders 202, 206, and 214 during current peak loading periods without poor voltage conditions and overloading distribution circuits. This situation will worsen under anticipated future load growth
- ◆ Insufficient transformer capacity to handle the loss of the WAPA Pierre Substation 12.47 kV bus, the Evans Street Substation transformer, the Evans Street Substation 12.47 kV bus, the Ash Street Substation transformer, or the Ash Street Substation 12.47 kV bus during future peak loading conditions.
- ◆ Under projected future loading levels, there is an inability to handle the loss of Feeder 312 without overloading existing distribution circuits and creating poor voltage conditions on the system.
- ◆ The City's 115 kV transmission system does not operate in true "closed loop" fashion due to the present equipment configuration in the Evans Street Substation.
- ◆ The Evans Street Substation transformer is nearing the end of its useful life and is in need of replacement.
- ◆ The configuration of the 12.47 kV busses and vacuum fault interrupters (VFIs) at the Evans and Ash Street substations could be improved to provide a safer and more reliable arrangement.
- ◆ There is a relatively small number of 12.47 kV distribution circuits making up the City's system for a city the size of Pierre. Therefore, disturbances on the system can cause outages to more widespread areas of the system.

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- ♦ Portions of the existing underground primary system are growing old and are in need of replacement.
- ♦ During the calendar year of 2007, the City's minimum power factor requirements required by the contract with MRES were not met.
- ♦ Many old oil-filled pieces of switchgear are installed on the system. Their age and performance is a concern.
- ♦ The City's system contains many sectionalizing devices which should be reviewed for system coordination.

### **CAPITAL IMPROVEMENTS PLAN SUMMARY**

The following table summarizes the recommended improvements and associated costs necessary to resolve the system deficiencies:

<b><u>CIP Component</u></b>	<b><u>Estimated Cost</u></b>
<b>Phase 1 (2010-2012)</b>	
New Northeast Substation	\$ 3,374,000
New 115 kV Transmission Line	2,009,000
New Northeast Substation Feeders	2,384,000
New Evans and Ash Street Substation Feeders	1,166,000
Coordination Study	<u>30,000</u>
<b>Total – Phase 1</b>	<b>\$ 8,963,000</b>

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### Phase 2 (2012-2015)

Evans Street Substation Improvements	\$ 3,133,000
Ash Street Substation Improvements	1,255,000
Feeder 202, 212, 214 Mainline Replacement	1,885,000
Power Factor Study	<u>10,000</u>

**Total – Phase 2**                      **\$ 6,283,000**

### Phase 3 (2015-2019)

Feeder 210 and 302 Mainline Replacement	\$ 5,845,000
Miscellaneous Circuit Ties	<u>305,000</u>

**Total – Phase 3**                      **\$ 6,150,000**

**Total – 10 – Year CIP**                      **\$ 21,396,000**